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DEPARTMENT OF AGRICULTURE.

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DEPARTMENTAL NOTES.

Land suitable for rice cultivation is offered on the Navuso Estate at Naduruloulou on the Rewa and on the Naitata and Vuninokonoko Estates at Navua. The land is situated on the river flats and is of excellent quality for the production of rice and various other crops. Blocks in area up to 10 acres may be leased at moderate rentals. Tenants will be required to use the major part of their holdings for rice growing and to sell to the Suva Rice Mill three-fourths of the crop. Applications will be received at the farm by the Manager, Navuso Estate; the District Commissioner, Navua; and the Department of Agriculture, Suva.

The price of paddy for the season has been fixed at £10 per ton. Bags will, if arranged for, be supplied by the Suva Rice Mill, and freight will be paid from any wharf from which steamers sail for Suva. Already large parcels are offering and it is expected that the quantity purchased and prepared for sale by the mill will far exceed that of last year. The increase in the production of this valuable and necessary food grain will be very satisfactory to the community generally. The increased facilities for closer settlement on land of good quality should also be appreciated by small cultivators, an increase of whose numbers would be of value to the Colony.

Among the operations for the coming spring season at the Nasinu Experiment Farm will be trials of maize in the types of soil best suited to that crop. Seed which has undergone careful selection for several generations only will be used and the value of fertilizers for improving the crops will also be tested.

A number of varieties of grasses for use on the various types of soil available will also be tested.

The citrus and banana plantations are being treated with a view to their restoration by various methods including green and artificial manuring.

Investigation of diseases of bananas, citrus trees and rubber is being thoroughly carried out.

During the month the Committee of Management of the Tailevu Returned Sailors' and Soldiers' Settlement paid a visit to the area. Every occupied farm was visited and notes of progress were taken. The majority of the settlers were comfortably housed either in bures or wooden houses. About 1,000 acres have been partly cleared for laying down pasture and on a number of farms the improved land has been judiciously subdivided into small paddocks. On some of the farms there were fair-sized areas of para grass on the river frontages which if carefully grazed, or still better, cut, will afford a good reserve of pasturage or fodder while other grasses are becoming established.

REPORT ON COCONUT DISTRICTS OF VUNILAGI AND MACUATA.

By H. W. SIMMONDS, F.E.S., Acting Government Entomologist.

In consequence of the report of out-breaks of certain diseases of coconuts at Vunilagi and Macuata, in Vanualevu, it was decided that the Acting Government Entomologist should make a visit to these districts, and at the same time it would enable him to see the estates in Ovalau and Moturiki where *chalcid* parasites of the scale *Aspidiotus destructor* had been recently liberated.

The following is the Acting Government Entomologist's report:—

INSPECTION OF PARASITES OF "A. DESTRUCTOR."

With these objects in view I left Suva on the 10th of May, first going to Levuka, and thence to the Island of Moturiki. At the western end of this island there was an undoubted improvement in the condition of the trees, but in the eastern portion little if any improvement was apparent. On examination of the affected area the large yellow *Chalcid, Aphelinus chrysomphali*, was found to be well established. and doing good work; but the smaller species *Aspidiotiphagus citrinus* was not observed except in the pupa state on some of the trees just recently placed there. The larger form of *A citrinus* was also present on some of these new trees, and had bred on one at the extreme eastern end. The condition of many of the bush trees here was very bad, being affected with *destructor* to a terrible extent. From Motoriki we proceeded to Bureta on Ovalau. Here there was an undoubted improvement in many of the trees, especially in the more sheltered positions. This freedom from *A. Destructor* is also apparent in similar situations in Tahiti, and shows how large a part the wind plays in the distribution of the disease. At Bureta the small form of *A citrinus* was found to be numerous and well established, whilst a few *chrysomphali* were also seen. As none of the larger pupæ of *A citrinus* were observed it seems probable to me that there are here two species confused as one, and considerable investigation will be required to decide this point. As *citrinus* had not established itself at Moturiki a number of pupæ were taken across, and it is hoped that they will soon become equally numerous there also. Waidau was next visited, and it was found that *A citrinus* had already reached this estate, but the larger *A chrysomphali* was not observed. It is satisfactory to find that both parasites are now well established, and should it prove that there really are two species confused under the name of *A citrinus* it is hoped that the second form will also make good, and that in a year or so there may be a solid improvement in these areas. Whilst it is early yet to make a definite report, it may eventually pay in certain of the more exposed portions to have a number of the trees cut out as they act at present as nurseries whence the disease is spread to the remainder of the district.

MACUATA COAST.

From Levuka I proceeded to Naduri and Macuata Island, from which latter locality scale and beetle had been reported. No signs of beetle were found, and no one there had heard of it, but several trees had been attacked by the Mealy bug *Pseudococcus cocotis* to a very severe extent and these had mostly been cut down and burnt by the natives. On one that was still standing I observed the ladybird *Neda tricolor* (*Croich*) whose larvæ feed upon this bug.

On a dead tree trunk adjoining the scale *Aspidiotus aurantii* was present, as also on one other tree; and these we instructed the owners to burn. A white scale near *Poliaspis* was also found at the bases of a few leaves. It did not seem to be doing much harm, but will be forwarded to London for definite identification.

At Raviravi many areas were in a very bad state as viewed from the sea, but no opportunity occurred to visit this district. From inquiries the trouble was probably the beetle *Promecotheca reichei*, which is always heavily parasitised. The whole condition of the nuts in this area was, however, very unsatisfactory, with very small yields and undersized nuts; yet amongst them were occasional trees with good heads of nuts, showing that the situation is not unsuitable for the industry.

VUNILAGI.

From Macuata we made our way *via* Labasa overland to Vunilagi, where eight days were spent. Here a good deal of disease was found to be present.

LEPIDOPTERA.

A leaf-eating moth *Agonoxena arguala* was present in large numbers, destroying from 5 to 10 per cent. of the total green leaf material. This larva feeds under a web on the undersides of the leaves, destroying the tissue in straight lines very like the attack of *Levuana*. When fully fed the larva generally drops to the ground and there spins a curious flat cocoon on the upper sides of leaves, grasses, &c., a few however do not drop but remain on the tree and pupate on the undersides of the leaves. A large number were collected and a few specimens of a *Chalcid* parasite were bred out.

A *Braconid* was also bred from one pupa, and it is possible that this species is parasitic on the *Chalcid*. A considerable amount of work remains to be done with this insect, but in the meanwhile it would probably pay to collect the pupæ by hand in numbers, which is easily done on the low herbage, and then breed out and destroy the moth and liberate the *Chalcid*, first destroying the suspected secondary parasite.

Two spathe-boring larvæ were found to be very numerous. First a large species which destroyed a great deal of the inflorescence, and in one case had apparently killed the whole spathe. This species is apparently the same moth that was bred out by Jepson, from Taviuni, and has been described in a pamphlet issued by the Department in 1915.

A small Pyrale was also present, and this generally attacked the young nuts. Larvæ were brought away and it is hoped to breed the moth out shortly. Further investigation is much needed as to both these insects, and it may be possible to devise some method of trapping the former during its descent to the ground where it pupates.

COLEOPTERA.

The minute beetle *Calandra taitensis* was found in several nuts, whilst its larvæ were found in borings at the bases of the leaves. I do not consider that this species is a very serious danger at present. In one portion of the estate a number of the leaves had been attacked by the leaf miner *Promecotheca reichei*, but as in Jepson's visit not a single living specimen was found. This insect is always heavilyp arasitised and a dead Hymenopterous parasite was found in one of the burrows.

OTHER DISEASES.

Hermit crabs destroyed a fair amount of the flowers, especially of the female ones and they may require to be collected by hand.

At the top end of the estate the stick insect was very bad. Smoke will often cause them to drop, whilst the burning off of the undergrowth will destroy their eggs in large numbers, which are simply dropped to the ground. The Australian Magpie is a bird which has been introduced into Taviuni for this pest; and, as it is a grub and insect feeder solely, might with advantage I consider be brought across to Vanua Levu.

THE RIPE NUT MAGGOT.

A species of fruit fly of which I have not yet obtained the name, does a good deal of damage to fallen nuts, from ½ to 1 per cent. of the total crop probably being lost from this cause. The fly lays its eggs on those fallen nuts which have, so far as I have been able to see, always lost their calyx in falling. The young maggots then enter the nut through the eye, where they turn the contents into a foul-smelling mass of slime. When the maggots, which are of two colours, white and grey-green, are fully fed, they leave the nut and enter the ground to pupate. The fly was very common. If the nuts were hand-picked for a year or 18 months and not allowed to lie on the ground, I think that this pest would quite disappear, although it would enter from the adjoining estates from time to time. Careful close collection would also assist, but in that case I consider it would be well to pick certain nuts which although fully ripe have remained on some of the trees.

A FUNGOID DISEASE OF THE TREES.

Mr. Forbes, the manager of the Vunilagi Estate, called my attention to an area of perhaps one-eighth of an acre where many of the trees had fallen. The trees themselves showed no sign of disease so far as their tops were concerned, bearing good heads of nuts and flowers and then suddenly falling to the ground, perhaps on a perfectly calm day. On examining the breaking point the trunk was found to be half decayed away and further investigation showed that several of the adjoining trees were affected in the same manner. The disease is, apparently, fungoid, and is the most serious menace I have observed in Vaunalevu.

There is first an outer area of dead wood heavily perforated with beetle borings. Inside this is a stained area generally free from the borings, and next to this comes the sound wood. On examining the roots they were found to be dry and unhealthy. The diseased wood however did not generally reach to the base of the tree but occurred from 6 inches to about 2 feet 6 inches from the ground. At the top of the diseased area about this point the tree generally attempted to throw out new roots, which however quickly died. Specimens have been brought away for microscopic examination, and meanwhile I have recommended—

that the diseased portions of all affected trees be cut out, and the wound covered with tar;

that the whole affected area be heavily limed, and also that the adjoining trees be sprayed with lime sulphur.

As I also heard of the disease from several other places on the coast, I would recommend that an Inspector be sent up at once to make a complete tour of this coast and see that all affected trees be cleaned in the manner suggested and the dead wood and stumps be burned.

BEES.

Few bees were seen in the estates. As in Tahiti and Rarotonga these insects are supposed to play an important part in the fertilization of the flowers, I would advise that a number be kept for that purpose, thus helping to economise the pollen of the male flowers, so many of which have been destroyed in the manner indicated above.

BIRDS.

As general enemies of all insects the native birds play a most important part. Unfortunately the introduction of the mongoose has led to the destruction of many of the ground feeding-species, and these would have been most valuable against such insects as the spathe boring moth. Planters would I consider be well advised to leave small areas of native bush in the centre of their estates as breeding grounds for the native species, whilst the planting of flowering trees about the homestead always tends to attract the insectivorous forms.

RATS.

A few nuts destroyed by rats were observed, but the damage done by these animals was not apparently nearly so severe as in the Eastern Pacific, where the losses are very heavy.

One grower in the Marquesas estimated his loss at two-thirds the total crop; whilst on Moorea, in the Societies, I counted over 30 recently fallen nuts under one tree. I think we probably enjoy our comparative immunity to the work of our native owls, which birds are natural enemies of rats and also destroy many large moths.

GENERAL CONDITION OF VUNILAGI TREES.

The general yield of nuts on Vunilagi was disappointing, whilst many were small. Disease doubtless accounted for some of the small heads, but want of selection of good nuts for planting played a big part. Certain trees grew with their leaves at an acute angle, and such trees never bore as good heads as those with more widely spread leaves.

COMMERCIAL AREA FOR COCONUT CULTIVATION.

I consider that the Department of Agriculture should have a commercial area in a good coconut district where all varieties of nuts should be cultivated and their relative yields tried out. Also such experiments as clean weeding, cultivation of leguminous cover crops, &c., tried.

Such a farm should have proper accommodation for extended visits by the Superintendent and the Entomologist to carry out investigations, which cannot be done in Suva. If properly carried out such a farm would be no charge on the community, but a paying proposition.

I desire to express my thanks and appreciation of the kind hospitality extended to me at the various places I visited, and the assistance rendered to me by all with whom I came in contact.

FURTHER NOTES ON THE VISIT TO VANUALEVU.

By H. W. Simmonds, F.E.S., Acting Government Entomologist.

Since my report on my visit to the coconut districts of Vanualevu a considerable number of specimens obtained there have been bred out.

The small moth larva which attacks the young nuts is apparently *Harplagoneura complena* (Boisi), and has been previously bred from Taviuni by Jepson. Up to the present no parasites have been recovered, and the amount of damage done by this insect seems to be greater than when Jepson visited these districts. The moth or a closely allied form is also reported from the New Hebrides, where further investigations might be carried on in the future. A large number of the fly which attacks the ripe nuts have been bred. These are very close to, but seem to differ slightly from, the Rarotonga form. As one nut will yield many hundreds of specimens the necessity for very close collection is apparent.

The small leaf moth *Agonoxena arguala* (Meyi) is very heavily parasitised, the final figures being:—Moth, 36; *Chalcid* 34; *Braconid*, 2; equal to 50 per cent. parasitism. It would be easy to collect large numbers of these, which if bred out under mosquito netting would allow of the escape of the parasite, whilst retaining the moth.

HISTERID BEETLE PLAESIUS JAVANUS.

By H. W. Simmonds, F.E.S., Acting Government Entomologist.

When leaving on their recent tour of inspection of the banana districts, I showed our two Inspectors, Messrs. Gordon and McNamara, a specimen of the Histerid beetle, *Plæsius javanus*, which had been introduced into Fiji from Java by the late Government Entomologist, Mr. F. P. Jepson, as an enemy to the banana borer *Cosmopolites sordida*. I have now to report that Mr. McNamara was fortunate enough to capture a specimen at Nabalau; one of the estates upon which *P. javanus* was originally liberated, and which he brought back to me alive.

This is a most interesting find, as it shows that the beetle has established itself here, although still rare; and it is the first time it has been found since three months after they were liberated eight years ago. In this connection it is of interest that it is never common, even in Java; whilst in Hawaii, where it was also liberated by Muir, up to the present it has not apparently been recovered in the field.

I may add that Mr. Gordon informs me that the banana borer, *Cosmopolites sordida*, was comparatively less in the Nabalau Estate, where the *P. javanus* was recovered, than in other banana plantations visited by them during their tour.

A BRACONID PARASITE OF THE FRUIT FLY, DACUS PASSIFLORAE.

By H. W. Simmonds, F.E.S., Acting Government Entomologist.

This fruit fly, which does considerable damage to granadillas, oranges, and mandarins, lives through a considerable portion of the year in the fruit of the guava.

In 1916, Mr. F. P. Jepson records having obtained a specimen of a parasitic *Braconid* from some granadillas infected with the above fruit fly.

In view of the above, and as this fly does not become numerous until towards the end of the citrus season, I commenced a systematic search for its parasites, with a view to finding if possible their haunts.

A number of infected oranges and mandarins were bred out without result, yielding the *Dacus* only.

Early in May, whilst visiting Ovalau, I saw the *Dacus* at work on guavas on the Waidau estate. Whilst watching I saw a brownish *Braconid* walking round the infected fruits. I had no doubt that this insect was searching for the larvæ of the *Dacus*. I therefore collected a number of the stung guavas and these were placed in covered jars on sand, and as I had myself to leave for Vanualevu next day they were left in charge of Mr. Forsyth at Levuka. They took four weeks to complete their metamorphosis, and I was pleased to find about 25 per cent. of the *Braconid* parasite amongst the *Dacus* adults.

Further experiments will be carried out to ascertain the general degree of parasitism, but I think it probable that the *Braconid* keeps the fly under strict control during the greater portion of the year, and that it is only after the citrus crop begins to ripen that the fly finds in the peel of the orange a

protection sufficiently thick to save its larvæ from the short ovipositor of the *Braconid*. So far as I could observe the *Braconid* only searched those fruits still on the tree for the larvæ of the Dacus, and made no attempt on those which had fallen to the ground.

About 12 years ago Major Broun, of Auckland, identified three species of fruit fly in our citrus fruits. Not only our own *D. passifloriæ* being present, but also the Queensland species *D. tryoni* and the much dreaded Mediterranean species. Neither of the latter has been taken here either by Mr. Jepson or myself, and there seems to me little doubt that if his identification was correct this parasite has relieved us of their attacks.

As a practical method of dealing with the trouble and in view of our re-opened citrus trade with New Zealand, I would suggest—

(1) that citrus fruit for export be grown in proper orchards;
(2) that no guava be allowed near if possible;
(3) that all stung oranges or granadillas be collected every week and burnt;
(4) that all orchards be registered and subjected to inspection by our Inspector, and that any fruit not grown in such registered orchard be charged double rates for repacking;
(5) that after a date to be determined no fruit be allowed to be exported unless grown in such orchard.

I have to thank Mr. Forsyth, of Levuka, for kindly looking after the stung fruit during my absence.

A BACTERIAL DISEASE OF PARA RUBBER.

By H. W. Simmonds, F.E.S., Acting Government Entomologist.

When walking recently through a plantation of Hevea rubber in the Navua district my attention was attracted by two trees not far from one another in a very diseased condition.

Disease showed in the renewed bark which was rough and discoloured. Shot-hole borers had attacked this diseased area and latex was flowing freely from their borings. Probably ½ a lb or more had collected at the foot of the tree, whilst in one a big mass had formed between the cortex and the cambium, forcing the former away from the latter. In both trees the bark was stained a reddish brown which in the one tree had also affected the cambium whilst a slightly sour smell seemed to be present.

A number of slides were made, but no mycelium was found, and I was therefore led to suspect bacterial agency. Specimens were handed to the Government Bacteriologist, Dr. Carment, who found bacteria present in each case and whose report is appended.

The disease is not new, trees showing these symptoms having been present in Fiji for many years. It is probably carried from one tree to another on the tapping tools of the coolies, and is evidently not highly infective. If observed early and tapping be suspended and the bark scraped and painted with a strong disinfectant there should be a fair prospect of saving the tree, but if neglected until the tree is ringed and the cambium affected it would be wiser to cut the tree out at once.

A BACTERIAL DISEASE OF RUBBER TREES.

By Dr. A. G. CARMENT, Government Bacteriologist.

The rubber bark brought to me by the Government Entomologist had a dark red-brown sodden appearance. With a sterilised razor a small piece was cut with no contaminated surface and dropped on to glucose agar medium in a culture tube.

After 24 hours at 37 C there was a syrupy light-brown growth and also that of fungus (extraneous). From the former a pure growth was obtained and a hanging drop preparation from this showed that the organism was a short rod (often two joined end to end) which was actively motile having a whirling movement and often darting off in various directions. There was no evidence of spore formation. Experimental inoculation of a rubber tree with this organism was performed.

About 14 days after Mr. Simmonds, the Entomologist, gave me a piece of bark from the inoculated area of the tree. This when placed on the culture medium produced a similar growth and on microscopic examination the organism seen was indistinguishable from that in the original culture as regards morphology and activity. The presence of a pink coloration of the Cambium layer was characteristic.

THE PARTIAL SUCCESS OF THE TACHINID PARASITE OF THE SUGAR-CANE BEETLE BORER.

By ROBERT VEITCH, B.Sc., Entomologist to the Colonial Sugar Refining Coy.

In 1910 Messrs. Muir and Kershaw, two English entomologists employed by the Experiment Station of the Hawaiian Sugar Planters Association, arrived in Fiji and established an intermediate breeding station at Nausori mill for the purpose of transporting a parasite of the sugar-cane beetle borer (*Rhabdocnemis obscura*, Boisd) from New Guinea to Hawaii. This parasite had been discovered by Mr. Muir after years of discouraging and, at times, dangerous investigations in various tropical countries where the sugar-cane borer was known or believed to occur. The discovery of the parasite marked the successful conclusion of the first stage of the campaign for the control of the borer by parasites introduced to the Hawaiian Islands, but two difficult stages still remained, namely, the successful transportation of the parasite from New Guinea to Hawaii and its subsequent establishment in the plantations of the latter country.

The life cycle of the fly is so short that it could not be transported direct from New Guinea to Hawaii, and intermediate stations were established at Mossman mill in Queensland and at Nausori mill in Fiji; borers containing parasites were brought from New Guinea to Mossman where the larval parasites eventually developed into the sexually mature flies which then parasitised fresh borer larvae placed in canes obtained from the fields near Mossman mill. The canes containing this new generation of parasites were then brought to Nausori where the breeding process was repeated and the third generation was then taken on to Hawaii. In this way the second stage of the enterprise was brought to a successful conclusion. The parasite was subsequently bred in cages from which colonies were liberated at frequent intervals until it was eventually distributed and established throughout the whole Hawaiian group.

The discovery of this parasite (which is a small fly called *Ceromasia sphenophori*, Vill.) seemed to open up good prospects for the control of the chief sugar-cane pest in Fiji, and Messrs. Muir and Kershaw left a colony at Nausori, but unfortunately it was not successful. Mr. D. S. North, pathologist to the Colonial Sugar Refining Company, then brought a colony from Hawaii, and two other colonies were also sent to the Vancouver-Fiji Sugar Company at Navua, but all these three failed, and so a further colony was introduced by Dr. Illingworth in 1913; the writer brought a final colony over in 1917.

It was thought that all these colonies had failed completely owing partly to the large number of enemies of the parasite in the sugar-cane fields of Fiji and partly to the agricultural conditions being less favourable than in Hawaii, where success was undoubted. Such a result was extremely disappointing because from 1913 to 1918 breeding work was carried on by no fewer than twelve of the Company's officers and it is seldom that such a prolonged effort has been made to establish a parasite. It is however,, pleasant to be able to record that the fears of complete failure were erroneous, because success has at last rewarded these prolonged efforts in at least one of the districts; an inspection of the plantations in the vicinity of Nausori mill towards the end of 1920 showed that the borer had decreased tre-mendously since 1917 and the parasite was found to be quite common in many of the fields. It is hardly fair to claim that the reduction in borer damage is due entirely to the establishment of the fly because in recent years Badila, a variety that is highly susceptible to borer attack, has largely been replaced by Malabar, which is generally much freer from attack, but even when allowance is made for this change in variety, there is evidence of a very distinct improvement in the situation.

In 1911, *i.e.*, before the fly was established at Nausori, 23 per cent. of the crop was Badila, 74 per cent. being Malabar, while 1919 in the figures were 22 per cent. and 77 per cent. respectively; it may be said that the relative position of the varieties was the same in these two years. The percentage of stalks received at the mill showing borer damage was 13 in 1911, while in 1919 borer-infested stalks represented only 4 per cent. of the total crop crushed. This is surely conclusive evidence of the great improvement in the situation, an improvement that is of very great importance because it means the saving of thousands of pounds annually at Nausori. A decrease from 13 per cent. to 4 per cent. of borer infested stalks is a very decided success.

The position at Nausori is extremely gratifying after the bitter disappointment of apparent complete failure. This incident shows the difficulty and uncertainty of parasite introduction and it illustrates the necessity of extreme patience and optimism. It is possible that the Nausori success will be duplicated elsewhere, but it must frankly be admitted that the conditions at the other mills are not quite so favourable; nevertheless the success at Nausori is so distinct that further efforts are now in hand to extend the range of activities of the parasite. The success at Nausori should not be accepted as a reason for releasing the control measures at present enforced elsewhere, particularly at Labasa; these measures are of great value even where control by parasites already exists.

ANIMAL DISEASES.

By Dr. CARMENT, Government Bacteriologist.

Conditions of Fiji climate moisture and heat is suitable for the development of fungi and that these play a large part in the production of disease conditions in man, animal and plant is evident. There is a fair field for mycological work, so far untouched.

FIJI SORE IN HORSES.

This developes on the fetlocks with swelling and then large warty growth, which is either cut off (in the way of treatment) or bitten or knocked off by the animal, leaving an indolent ulcer. It was formerly believed to be due to filariæ. A case was brought to my notice which after six months' treatment had shown no improvement. Smears from the washed ulcer when stained with cosine and carbol thionin, showed rounded bodies full of large oval spores which took on a pink stain, and direct cultures showed the presence of *Sporotrichon beurmanni*. Inoculation experiments on a dog and guinea pig failed to reproduce the disease, but typical growths were obtained on glucose agar. Growth from single spores of the fungus produced a beautiful stellate appearance. In spite of very haphazard treatment this case cleared up in two months. Ulcers were painted with strong Grams Iodine Solution, and Potassium Iodine was given as a drench.

DRIED BANANAS.

By C. H. WRIGHT, M.A., F.I.C., Government Chemist.

Considering the large quantities of bananas which are grown in Fiji it is surprising what little use has been made of them as food. A certain quantity are of course eaten as food by Fijians, but the remainder were until recently nearly all exported for consumption as fresh fruit. But now that the Australian market is closed owing to the high import duty recently imposed, it is advisable to consider whether some use could not be made in Fiji of the large quantities of bananas, which were formerly exported to Australia.

With the object of finding some solution of this problem, and also helping anyone who is interested in the question, dried bananas were prepared at the Chemical Laboratory during this month (July); samples of the "banana chips" and "banana flour" so prepared can be seen there by anyone who wishes to do so. The objects of this work were to learn something more than can be found in books as to the preparation; to determine the yield; and to obtain sufficient of the flour for analysis and for trials as a food. The analysis of the banana flour prepared at the Laboratory is not yet complete nor have trials yet been made as to the possibility of using it in making bread. It is hoped to consider these and other matters in the next number of the *Agricultural Circular*.

PREPARATION.

The preparation of banana flour is thus described by W. Fawcett in *The Banana, its Cultivation, Distribution and Commercial Uses*, London, 1913, pp. 114–115:—

"Banana flour is made from the fully grown unripe banana, that is, before the starch is changed into sugar in the ripening. It is difficult to peel green bananas, but if they are first put into scalding water (176° F.) for

four or five minutes, the peel is easily removed. The peeled fruit is dried in the sun or put into a dryer of some kind to reduce the percentage of water from 75 to 15. The drying is more readily effected if the fruit is cut up small. Steel knives should not be used as they turn the banana black; nickel blades are better, and very effective knives can be made from bamboo. The peasantry in Jamaica, after taking off the skin, cut the bananas into thin slices and lay them on stones in the sun. One day's hot sun is sufficient to dry them, after which they are put into a mortar, pounded and then sifted. Two bunches make ten quarts of flour."

In the experiments carried out by me at the Chemical Laboratory the fully developed but unripe green bananas were dropped into boiling water and left there for about five minutes. They were then immersed in cold water, and when cold they were peeled with a rustless steel knife. It is well known that if a green banana is cut with an ordinary steel knife the knife is turned black, and the banana is discoloured. This is due to the tannin in the green banana, which forms a black compound with iron. Hence Fawcett recommends nickel blades or pieces of split bamboo; but what is far preferable is a rustless steel knife, which was used in my experiments for peeling and cutting up the bananas, and even when smeared with the juice of the green banana and left over night did not show any signs of discolouration. The peeled bananas were then cut lengthwise into four or five strips, which were then dried in the sun. Even lately, when the weather in Suva has not been very favourable for such work, it was found that they were nearly dry after one day's exposure to the sun. It is necessary that the slices of banana are dried as quickly as possible; otherwise the ripening process goes on and the starch in the banana is converted into sugar; the pieces of banana then become coated with a sticky sugary layer, which will not dry. In view of these facts drying in a dryer would be far preferable to sun drying. The dry slices of banana are known as "banana chips"; they are quite hard and break with a distinct snap; they are like a dry unsweetened biscuit to eat and have a faint agreeable taste similar to that of the banana.

Banana flour is made by grinding the "banana chips." In my experiments the latter were ground in a coffee-grinder. As thus prepared the banana flour is pale yellow, and has a faint sweetish smell. No doubt if I had the means of grinding it more finely and then sieving it, the flour would be whiter, and perhaps more attractive in appearance. Fawcett, *loc. cit.*, p. 115, states that in a factory at one time in operation at Montpelier, Jamaica, the bananas were dried in a vacuum dryer in which they were stirred and cut up. "The drying was complete in about two hours; by this time the bananas had been reduced to the appearance of somewhat coarse flour with only 15 per cent. of water. The mass was removed from the dryer, and passed through sieves containing 120 meshes to the square inch. Whatever remained in the sieve was passed through a simple mill and sifted afresh." The object of this sieving is, however, not quite obvious since there is nothing objectionable in the dried banana; and it would seem that a very palatable flour can be obtained from the "banana chips" by grinding only.

YIELD.

A short time ago as a result of an inquiry I looked up the subject and was unable to find in any book or journal the average weight of a banana and the ratio of skin to pulp. But I did find in Thorpe's *Dictionary of Applie Chemistry*, article Banana, an analysis by Leuscher of the pulp of the unrip banana and in Fawcett's *The Banana*, p. 110, an analysis of banana flour by

H. H. Cousins, Director of Agriculture, Jamaica. From these analyses the percentage of starch in the pulp of the unripe banana is 19·1 per cent., and in the banana flour it is 60·4 per cent. Hence 100 lb of the pulp of the unripe banana contains 19·1 lb of starch. This weight of starch is contained in $19{\cdot}1 \times 100/60{\cdot}4 = 31{\cdot}6$ lb of flour. That is to say the banana pulp yields 31·6 per cent. of its weight of banana flour. This figure is of interest because by actual experiments described later I found that the average yield was 31·4 per cent. Remembering that bananas, like all natural products, vary in composition this is a very satisfactory agreement.

In the experiments carried out by me an enamelled iron bowl or plate was weighed to the nearest whole gram. On it were placed two or three fully developed but unripe bananas and weighed again. These bananas were then peeled as described above and the bowl or plate together with the peeled bananas weighed. The peeled bananas were then cut up with a rustless steel knife on the same bowl or plate, and were heated in a steam oven until they were dry. The bowl or plate together with the "banana chips" were weighed at intervals until the weight was constant. In this way I found the weight of one banana, the percentage of pulp in the whole banana, and the yield of "banana chips."

As was to be expected the weight of a banana varies considerably; even the bananas on one bunch vary greatly in weight, depending on whether they are taken from the upper, middle or lower hands. In all I weighed 37 bananas, and the weight of one banana was found to vary from 109 to 144 grams with an average of 132·4 grams (=4·67 oz. Av.). As the average of six experiments I found that the peeled fruit amounts to 55·3 per cent. of the whole banana, or in other words the skin makes up 44·7 per cent. by weight of the green banana. In five experiments which agree very closely amongst themselves I found that the dried bananas ("chips") are 17·3 per cent. by weight of the whole green bananas, and 31·4 per cent. of the peeled fruit (pulp).

From the above data it is now possible to calculate the yield of banana flour per bunch. For the sake of the calculation suppose that a bunch consists of 100 bananas. Then 100 bananas will weigh $132{\cdot}4 \times 100 = 13{,}240$ grams. This will yield 17·3 per cent. of its weight of dried bananas; hence the weight of dried bananas $= 13{,}240 \times {\cdot}173 = 2{,}290{\cdot}5$ grams $= 5{\cdot}05$ lb. If the bunch consisted of 150 bananas, then the weight of dried bananas obtained would be $5{\cdot}05 \times 1\frac{1}{2} = 7{\cdot}58$ lb. It will be noticed from the quotation given above that Fawcett states that one bunch of bananas yields five quarts of flour. I found that $\frac{1}{2}$ pint of flour prepared in the laboratory weighed 155 grams. Therefore one quart weighs $155 \times 4 = 620$ grams, and five quarts weigh 3,100 grams $= 6{\cdot}83$ lb. This agrees very well with the yield calculated above, and it may be safely said that the yield of flour from one bunch of bananas will be from 5 to $7\frac{1}{2}$ lb, depending on the size of the bunch.

INTENSIVE CULTIVATION.

By Albert H. Benson, M.R.A.C., Director of Fruit Culture.

In a young country like Queensland, with its vast undeveloped areas, it may at first sight appear somewhat premature to advocate intensive cultivation, and yet when one considers the subject carefully it is very evident that one of the greatest mistakes our agronomists have made has been the tendency to acquire more land or to put a larger area under cultivation than they can possibly attend to.

This fault is not confined to one particular class, as there is a general tendency to grasp more land than the owners or lessees thereof can possibly utilise to the best advantage.

In no branch of agronomy is this more evident than in that of fruit culture, as many of the failures in this industry are directly attributable to the orchardist's attempting to handle a much larger area than he can manage, with the result that the yield of his fruit trees, vines, or other fruit-bearing plants is very much smaller than they would have been had they been given the care they required to produce a maximum return.

The importance of maintaining an orchard in a vigorous state of health and of maintaining the soil in a high state of fertility—in other words, the intensive cultivation of the orchard—has been pointed out by me in my writings on many previous occasions, as I have always maintained and still maintain that a small area properly looked after will frequently yield a greater net return than a much larger area that is more or less neglected.

During recent years there has been a very great increase in the number of small fruit holdings, both in the coastal districts of Southern and Central Queensland and also in the granite belt, a large proportion of the occupiers of such holdings being returned soldiers. These small holdings, if properly handled, are ample to support their owners in comfort, provided they are utilised to the best advantage; that is to say, that they are made to yield a maximum return.

This can only be accomplished by keeping the soil in a state of perfect tilth and in a high state of fertility, and by keeping the trees, vines, or other fruits free from disease and in a state of vigorous growth. These conditions can only be maintained on comparatively small areas, as they demand the constant attention of the orchardist, which they would not get did he attempt to handle a bigger area than he is capable of dealing with thoroughly.

The profits to be obtained by intensive cultivation would astonish those who have not gone into the matter carefully, as when land is kept in a high state of fertility and cultivation and is utilised to the best advantage it returns many times the yield it would do were it treated in the casual manner that many of our farms, orchards and gardens are. To prove this, one has only to see the returns a Chinese market gardener gets off a small area which he works systematically and utilises to the best advantage.

Intensive cultivation demands two things:—One, the thorough preparation of the land and its maintenance in a state of perfect tilth; and the other, the maintenance of the fertility of the soil so that it contains an adequate supply of all essential plant foods in an available form. The former necessitates not only the working of the surface soil, but the deep stirring and pulverisation of the subsoil, so that the trees or fruit-producing plants grown

thereon may be induced to root deeply, and thus be able to withstand dry spells much better than they would do were the majority of their roots near the surface.

The latter is not merely a matter of supplying the land with certain plant foods required as nutriment by the particular tree or plant, but, what is more important, the plant foods added to the soil must be available. No plant foods that are added to the soil in the form of commercial fertilisers can be made use of by any plant until they are dissolved in the water contained in the soil, as they can only enter the plant when in solution, and then only by means of the growing extremities of the finer roots.

It will thus be seen that, unless the soil retains an adequate supply of water, the application of artificial fertilisers will do little good, as the plant is unable to make use of them. The retention of the necessary water in the soil is dependent first on the maintenance of the soil in a state of perfect tilth, so as to prevent the loss of moisture by surface evaporation; and, second, by keeping up the supply of humus or organic matter in the soil; as soils rich in humus have the power of absorbing and retaining more moisture than those that are deficient in this respect. Humus must be present in all soils in sufficient quantity, and when a deficiency occurs it must be made good either by the addition of farmyard manure or by the growing of suitable crops and ploughing them under—in other words, by green crop manuring.

Thorough cultivation and systematic manuring thus go hand in hand and are absolutely essential to the success of intensive cultivation.

Some years ago the Agricultural Chemist and the writer carried out a number of experiments for the purpose of determining the value of intensive cultivation as applied to the growing of bananas and pineapples, and the results of these experiments proved without a shadow of doubt that thoroughness in the culture of these two crops paid handsomely, and, further, that it was possible to so treat land that had been starved and neglected that could be made to yield returns equal to those obtained from it in its virgin state.

Quite recently a further practical example of the results obtained by intensive cultivation has been brought under my notice, and, as the results are so satisfactory and show what good land properly treated is capable of producing, I purpose describing it for the benefit of our young growers, to many of whom it should be a valuable object lesson.

The example to which I refer is on the property of Mr. W. E. Dean, Buderim Mountain, and consists of rather less than an acre of good volcanic soil that was originally scrub, and was first planted with bananas twenty-eight years ago. It remained under bananas for six years, when it was planted with paspalum and has since then been used as a grazing paddock, till broken up by Mr. Dean in 1919.

The paspalum when the land was broken up was saved, instead of being burnt, and was placed in the bottom of trenches 24 feet apart, on the top of which banana suckers were subsequently planted 8 feet apart in the row, or at the rate of 226 plants to an acre. Two hundred and nine suckers were planted in September, 1919. The land between the rows of bananas was well and deeply worked, and midway between the rows a double row of pineapples was planted, the lower side of the row being Ripleys and the upper smooths. The object of this method of planting the two varieties together was that the Ripleys, having a better hold of the ground, tend to

keep the smooths from falling over. This principle is evidently a good one, as the plants of both varieties show a very healthy and vigorous growth; the colour is excellent, and they are bearing a heavy winter crop.

The soil is a deep volcanic loam from which the basalt stones and small boulders have been removed. It is in good heart, and, as previously stated, is kept in a thorough state of tilth.

During the spring of 1920 the land between the pineapples and the bananas produced a heavy crop of cucumbers, for which a very satisfactory price was obtained, and the cucumber crop was followed by peanuts which have recently been harvested, so that it will be seen that none of the land has been allowed to remain idle.

With regard to the bananas, selected suckers having large well-developed bulbs and a stem about 3 ft. 6 in. long were planted in September, 1919, and these mother plants bore their first bunches during the end of 1920 and early part of 1921. From the mother plant only three followers have been allowed to grow, and these at different intervals, and so spaced that no one sucker interferes with another. All superfluous suckers were removed by means of a spud bar some 4 feet long and sharpened to a chisel point some $2\frac{3}{4}$ in. wide at one end. Such a tool does the work neatly and does not injure the parent bulb to any serious extent.

Of the 209 stools, each of the two oldest followers is now carrying a bunch, so that on less than an acre of land there are over 400 bunches, which average over 20 dozen individual fruits each, and one bunch had no less than $27\frac{1}{2}$ dozen.

The land is kept well worked right up to the pines and bananas, and there are no surface roots. The bananas are manured twice annually—the end of August and during February—when they receive either 2 lb of dried blood, $1\frac{1}{2}$ lb of superphosphate, and 1 lb of muriate of potash per stool at each application, or 4 lb of meatworks manure and 1 lb of muriate of potash per stool. The manures are distributed around the stools and are well worked into the soil, and cost at the rate of £25 15s. 9d. per acre. When the returns are taken into consideration, this is a reasonable expenditure; further, once the initial expense of preparing the land and planting the crops has been met, the upkeep of the land has been light, as it is in such good order that its cultivation is a simple matter. Horse, not hand, culture is employed, as there is no fear of damaging the roots.

The gross returns from this plot of land of less than an acre in extent will probably amount to over £400 in the year, provided the prices now being realised for bananas in the Southern markets are maintained, as the crop of fruit actually in sight is not far short of 300 cases, and, unless something at present unforeseen happens to destroy them, this quantity should be marketed. Mr. Dean's success is the result of good work well carried out, a striking example of the benefits to be derived from intensive cultivation, and a proof of my statement that a small area well worked will frequently yield a greater net return than a much larger area indifferently looked after. His success should also be an encouragement to many young growers who, instead of utilising their land to advantage, are frequently dissatisfied with the smallness of their holdings and think that they would do better if they had more land. In the majority of cases this is the greatest mistake they can make, as if they are not able to work a small area profitably they will have little chance of working a larger area to better advantage.—*Queensland Agricultural Journal.*

THE SOLO PAPAW.

The following remarks on a small-sized but fine-flavoured fruit, known in Hawaii as the "Solo," will be of interest. The information given is taken from the Report of the Hawaii Agricultural Experiment Station for 1919:—

"This variety of papaya, which has been under cultivation through four generations, has transmitted its characteristic flavour and texture, and, to a reasonable degree, its shape, in all of the plants of its kind that have come under observation. To this variety has been given the name 'Solo.' It is quite small, in some instances the fruit permitting of only one serving; in others, the fruit is large enough for two servings. Most plants of the variety are hermaphrodite or bisexual, but a staminate tree is found occasionally. Although the fruits are small, they are crowded into the axil of nearly every leaf, and are so numerous that the yield is reasonably heavy, yet not equalling in weight that of some of the large kinds. The fruit is pyriform, somewhat irregular, colours well and uniformly before softening, and is free from the diseased spots which attack the surface and penetrate the pulp of many of the large forms; tender almost to melting, and of delicious flavour even near the stem end, where many papayas lack flavour. The seeds, which are abundant, permit of ready and rapid means of propagation, and, because of the loose placenta or inner lining of the fruit to which the seeds are attached they are very easily removed when preparing the fruit for serving. From the standpoint of the home gardener, the 'Solo' is considered one of the best of the papayas that have been grown at the Experiment Station, for, although small, its qualities of texture and flavour give it first rank. The 'Solo' can be used as an individual fruit."

STORING AND CURING OF MANDARINS AND ORANGES.

In January, 1920, Mr. Jose G. Sanvictores, then Assistant Director of the Bureau of Agriculture, and Mr. H. A. Lee, Mycologist of the Bureau of Science, visited the Batangas Commercial Citrus Station. Among numerous suggestions made by them as to the work of the station it was proposed that the storage and curing of oranges be attempted. The advantage of such storage would be to distribute the selling season over a longer period of time, thus giving the growers a better price for their fruit as well as enabling the consumer to secure oranges at times when it would otherwise be impossible to get them.

The curing of fruit had been attempted previously by Mr. Lee on a small scale in boxes. Such preliminary investigations showed that the fruits could be made to assume a uniform orange colour and in addition their general quality was considerably improved. Following the suggestions of Mr. Sanvictores and Mr. Lee, a storage chamber was constructed at Tanauan. A vault was dug into a side hill, about 6 feet high and 10 feet square. The purpose of this underground chamber was to secure uniform temperature and moisture conditions. No ventilation was provided for in this first experiment.

The fruit from the station orchard was harvested on 31st January of this year, and about 1,500 oranges of the commonly-grown Batangas mandarin variety were placed in this vault. The fruits were handled with great care so as not to injure them, but they were not picked quite as carefully as they should have been. The men in handling the oranges in the storage chamber always disinfected their hands with carbolic acid before touching any fruit.

The result was very successful and gratifying. The fruits soon assumed a deep orange colour, the rind became thinner and the flesh less stringy and of better texture; the flavour of the fruit also was improved. This curing of the oranges was entirely finished twenty days after they were placed in the vault, the experiment, however, was continued to determine to what length of time such oranges could be held in storage. The results are shown in the following table:—

PERCENTAGE OF DECAY IN FRUITS OF THE BATANGAS MANDARIN ORANGE, CURED AND HELD IN STORAGE IN AN UNDERGROUND VAULT.

Size.	Kind of Fruit.	No. of Fruit. Jan. 31.	Decay, Feb. 19.		Decay, Mar. 10.		Decay, Mar. 31.	
			No.	%	No.	%	No.	%
2½	Clipped ripe	149	9	6	67	45	122	82
	Clipped green	241	9	4	136	56	213	89
	Ordinary picked ripe ..	100	6	6	8	8	52	52
	Ordinary picked green	263	10	4	78	30	160	61
2½	Clipped ripe	265	13	5	116	44	224	85
	Clipped green	157	6	4	87	55	142	90
	Ordinary picked ripe ..	100	2	2	8	8	57	57
	Ordinary picked green	180	9	5	38	21	99	55
2½	Clipped ripe	35	1	3	18	60	27	86
	Clipped green	30	1	3	15	43	19	90
	Ordinary picked ripe ..	35	1	3	15	43	19	54
	Ordinary picked green	33	1	3	12	36	22	67

The table shows that loss from decay was not serious during the first twenty days; thereafter the loss was so great as to make it impracticable to continue the experiment. Data are given in the table of the comparative merits of two kinds of picking, one by clipping the stems of the fruit with shears for that purpose, the other by plucking the fruits from the tree by hand. The table shows that there was a larger loss in clipped fruits than in those picked in the ordinary way; that a slightly larger loss was found in the green than in the ripe fruit; that size of fruit did not make any difference in its keeping quality.

These results have proved that mandarin oranges may be stored for a longer time than has heretofore been possible, not only without spoiling their flavour and appearance but actually greatly improving their quality. According to the methods used, twenty days is the longest period of time that is economically feasible. It is hoped next year, however, by more careful handling, by disinfection of the fruits before storing, and by ventilation of the underground storage chamber, to greatly increase the length of time during which fruits may be kept.

Another experiment has been conducted to determine the difference between fruit stored in underground cellars and fruit stored in open air. Of the fruits stored under the different conditions, open air, an aired shed, and non-ventilated underground storage, the percentages of loss were 24, 15½ and 26 respectively. Although the fungus decay of fruits was greater in the case of the underground storage than in the shed storage and open-air storage, the actual loss of fruits was greater by the latter two methods. This was due to shrinkage and hardening of the fruits in the dry open-air

storage, whereas in the underground storage such fruits as did not rot from fungus infection were much improved in colour, flavour, juiciness, texture and general quality.

Preparations are now under way for repeating these experiments next year, combating the fungus decay by careful handling, by fruit disinfection before storage, and by ventilation of the storage vault.—*Philippine Agricultural Review.*

CASSAVA AS A SOURCE OF STARCH AND FLOUR.

Cassava starch has been tried as a sizing material for textiles in this country, but up to the present it has not been accepted by either the wool or the cotton trade as a satisfactory substitute for the farina, sago flour, wheaten flour, or maize starch, to which they are accustomed. In this connection colour is an important factor; it has recently been reported to the Imperial Institute that successive shipments have been found to vary considerably in colour, and under the circumstances consumers will not believe that they are receiving a product of uniform quality, whatever may be the evidence of chemical analysis and physical tests. It is possible that cassava starch might also be regarded with less disfavour for laundry purposes if this variability were eliminated.

As a sizing material cassava starch would probably be found less liable than cereal flour to induce mildew in cotton goods, on account of its much lower percentage of proteins. A sample of cassava starch prepared in Rhodesia and examined at the Imperial Institute was found to contain only 0·1 per cent. of proteins. Wheat flour generally contains from 8 to 14 per cent. of proteins.

It is possible also that cassava starch would not produce the coarseness that is sometimes found in cotton goods stiffened with farina, which is supposed to be due to the large size of the starch grains in the potato. The granules of cassava starch, which in shape somewhat resemble that of a kettle-drum, average about 0·012 mm in cross section; they approximate in size the granules of maize starch, but are more regular in outline. Potato starch grains, which are somewhat oval in shape, vary in length from 0·05 to 0·14 mm the breadth being never less than about half the length. Cassava is sometimes preferred to other forms of starch for sizing coloured goods, as it gives a clear "mixing" which does not destroy the brightness of the colours.

Another purpose for which cassava flour and starch can be used instead of farina is in the production of adhesives, which is an industry of some importance in this country. Cassava is also used as a source of glucose, of which it yields about 30 per cent. calculated on the weight of the fresh roots, and it should form a satisfactory material for the production of dextrin and "British gum" as well as of the dextrin "syrups" used in confectionery.

The flour could also be employed, at least in the countries where the plant is grown, as a bread-making material. Comparative information regarding the use of a number of farinaceous materials, including cassava, in conjunction with wheat flour for the production of bread, is given in Bulletin No. 701 (1918), United States Department of Agriculture. *The Chemical Analysis of Wheat-Flour Substitutes and of the Breads made therefrom.* This publication gives photographs of loaves made from wheat in association with cassava and other farinaceous products. The bread made from wheat and cassava is described as having a remarkably fine texture and general appearance.

For particulars regarding the methods of manufacturing starch and other products from cassava reference may be made to the previous article in this Bulletin.

The Imperial Institute examined and reported on a number of samples of tapioca flour and cassava starch from British Possessions before the war, and these were valued at prices ranging from £12 to £15 per ton, according to quality, and especially colour, the best prices being paid for the whitish starch.

The pre-war price in London of Dutch farina, which constituted the greater part of the imports, was from about £9 to £13 per ton according to quality. German farina of ordinary qualities was quoted round about £12, while the best German farina realised as much as £16 per ton. Latterly Japanese farina has been coming on to the market in increasing quantities; early in the present year it was quoted in London at prices from 45s. to 60s. per cwt.

Early in 1919 cassava starch was quoted in London at prices from about 45s. to 50s. per cwt.—*Bulletin of Imperial Institute.*

HOW TO DESTROY LARGE JUNGLE TREES.

In clearing the jungle from an estate it is often a great source of trouble and expense to get rid of the large jungle trees. Too often does one see their stumps and roots remaining, a ready centre of fungus infection to the rubber trees just when they are beginning to bear at their best. The following note taken from the *Indian Forester*, May, 1920, may be of assistance to those about to clear jungle. Of course this method can only be employed whilst the tree is yet living:—

"Where it is desired to destroy a tree without cutting it down, a hole is bored in the tree in a downward direction to the centre. For large trees an inch auger is used; for smaller ones ½ inch size is large enough. For large trees 1 oz. to 2 oz. of ordinary commercial saltpetre (nitrate of potash) is used, and for smaller ones ½ oz. to 1 oz. A plug is put into the hole to keep the rain from washing it out. The nitrate of potash is carried by the sap to the tips of the branches and the rootlets. If the tree is a large one, say, 2 feet or more in diameter, very little difference will be noticed in the foliage for 2 or 3 months, then the leaves begin to fall, and it assumes a bare wintry appearance. At the end of about 6 or 8 months a little brushwood is piled around the tree and lit; it will smoulder away to the remote ends of the roots, sometimes 30 feet away from the tree, leaving masses of valuable ash; the tree will fall, and when fallen it will continue to smoulder until every particle is converted into ash.—*A Hand-book of Forestry* by A. D. Webster."

METEOROLOGICAL OBSERVATIONS.

JUNE.

Date.	Max.	Min.	Rain.	Date	Max.	Min.	Rain.
1	87·0	72·6	...	17	87·6	72·4	·65
2	88·2	74·0	·05	18	88·4	71·4	...
3	88·2	73·6	...	19	79·0	64·5	...
4	88·4	72·8	...	20	80·2	70·6	·30
5	88·0	73·0	...	21	79·4	65·2	...
6	88·6	74·2	·35	22	78·0	66·4	·45
7	87·2	73·6	...	23	80·4	67·0	·41
8	86·4	71·6	...	24	80·2	65·4	...
9	87·2	72·4	·32	25	78·4	64·2	...
10	84·6	70·2	·45	26	80·4	66·0	...
11	84·3	65·2	·05	27	79·6	64·8	·05
12	82·0	67·0	...	28	81·2	63·4	1·35
13	84·6	70·4	...	29	80·4	64·2	...
14	85·2	71·4	·15	30	79·2	63·8	...
15	86·4	72·0	·25				
16	86·4	70·0	·20	..	...	....	5·03

EXTRACTS FROM REPORTS OF INSPECTORS.

Mr. E. S. Gordon, Inspector of Produce, reports as follows for the month ended 30th June, 1921:—

Bananas Exported.—To New Zealand: 1,082 bunches; 18,047 cases; equivalent to 37,176 bunches.

Other Exports.—To Australia: Coconuts, 1,952 sacks; shell, 6 tons; rubber, 3 tons; to New Zealand: Kumalas, 190 sacks; mandarins, 146 cases; to Vancouver: Coconuts, 100 sacks.

Plant Matter, &c.—To Australia: 10 packets inspected; from Australia: 338 packages inspected; to New Zealand 9 packages inspected; from Tonga and Samoa: 27 packets fumigated.

Inspection of seeds and plants at Post Office.—Number of visits, 4; passed, 29 packages; destroyed, 1.

Inspection of Vessels.—Number inspected, 4; matter destroyed, 2.

REPORT FROM INSPECTOR FORSYTH.

Inspection of vessels.—Forty-four vessels were inspected and material likely to carry infection was destroyed in twelve cases.

Coconut Scale.—There is no further spread of this disease to report. There are signs of improvement in the badly-infected areas at Moturiki and on Ovalau, especially in the former area. Parasitised palms were distributed in these areas some months ago, and as recently as April and the beginning of May. During the month Mr. Simmonds, Entomologist, visited the various areas to investigate and report in regard to the successful introduction of the parasites. These have been established, and Mr. Simmonds will no doubt report fully on the subject . I am indebted to Mr Simmonds for much information useful to me in my inspection duties.

Reported outbreaks of scale at Macuata island and Munia (Lau) were investigated, Mr. Simmonds and I making a joint inspection at Macuata and various districts on Vanualevu. No *Aspidiotus destructor* was discovered though other scale was present. Material damage was not extensive and this scale does not appear to spread. Trees at Raviravi Point appeared to be suffering from a disease other than scale. Unable to visit this point, I have made arrangements for specimen leaves to be forwarded me as soon as possible. Specimens of the alleged scale from Munia have reached me and prove to be similar to that at Macuata, and distinct from the destructor. Trees throughout the areas visited are not bearing uniformly, the majority having heads of nuts much below the average. In Taviuni some care has been taken in selecting seed nuts for planting, and I ascribe the low-bearing quality of trees in these districts to carelessness in this respect and not to the want of quality in the soil altogether.

Mr. Simmonds carried on investigations at Vunilagi, while I proceeded to Savusavu. This was unfortunate, for I understand Mr. Simmonds discovered interesting specimens of various diseases.

I propose this week to transfer portions of parasitised palms to Wakaya. This estate is under the control of the Public Trustee, and for some time efforts have been made to eradicate the disease, with, however, only partial success. The presence of the parasite may be of assistance in keeping the disease within bounds. I also hope to visit Gau again in the near future to observe the effect of the lime sulphur spray used on yaqona patches which were badly infected.

Clidemia hirta.—A start has been made at Waidau, Bureta, and other places on the coast of Ovalau to eradicate this weed. There is a great difficulty in obtaining labour, but for the time being this has been overcome by contracting with natives at so much per acre (£2 average). I inspected work done and it appears to be satisfactory. The method adopted is to cut the root below the surface, turning the plant to dry, then firing. The growth is too strong for plants to be uprooted successfully by hand. It is also thickly interspersed with guava which is being cleared simultaneously. I shall experiment with the weedicide as soon as possible. As anticipated, the natives are not making any great effort to deal with their areas. As the law is at present constituted it is almost impossible to enforce it. Blocks are owned by groups and it is with great difficulty one is able to find an individual responsible for any particular portion of it. In all probability when ownership is determined it will be found that he is away working under agreement outside his district altogether. If they decide, as they probably will, on passive resistance it will be a hopeless task to find each responsible individual, serve the necessary notice, followed by prosecution in the case of non-compliance with orders. If it were possible to make a village or villages responsible for certain areas and fine them as a whole for neglect it would simplify matters considerably. I have given orders to the bulis of various districts to see that work is begun, and will also have the orders repeated through the Roko.

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